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L3: Entry 1 of 1 File: USPT Jul 25, 2000

DOCUMENT-IDENTIFIER: US 6093760 A
TITLE: Flame retardant for styrene resin and resin composition comprising the same

Brief Summary Text (8):
There have been known a resin composition comprising a polycarbonate, an ABS resin, a halogenated phosphate and a polytetrafluoroethylene (WO9106598), a resin composition comp-rising a polycarbonate, an AAS resin, a phosphate and a polytetrafluoroethylene (EP534297), a resin composition comprising a polycarbonate, an ABS resin, a phosphate and a polytetrafluoroethylene (DE4309142), a resin composition comprising a polycarbonate, an ABS resin, an aromatic phosphate and a metal salt of aromatic sulfinic acid (JP-A-6-299060), a resin composition comprising a polycarbonate, a polyester polycarbonate, an ABS resin, a phosphate and a polytetrafluoroethylene (EP482451), and a resin composition comprising a polycarbonate, an ABS resin, a phosphate and a polycarbonate-siloxane block copolymer (DE4016417). The phosphate to be incorporated in the foregoing polycarbonate resin composition comprises no phosphate having a specific substituent and thus exhibits a poor balance between non-volatility and flame retardance.

Brief Summary Text (13):
As approaches for flame-retarding the styrene resin there have been disclosed a flame retardant resin composition comprising a polyphenylene ether, a styrene resin, a metal salt of phosphoric acid and a phosphate such as tris(nonylphenyl)phosphate (JP-A-63-305161), a polyphenylene ether resin composition comprising a polyphenylene ether and a high molecular weight polyethylene as essential components, and optionally a phosphate such as tris(nonylphenyl)phosphate (EP550204), and a flame retardant resin composition comprising an aromatic polycarbonate, an ABS resin, an AS resin, a phosphate such as tris(nonylphenyl)phosphate, an aromatic sulfonate and a fibrous reinforcement (JP-A-6-299060). The resin compositions disclosed in the foregoing three documents comprise a phosphate such as tris(nonylphenyl)phosphate and thus exhibit a low flame retardance. These resin compositions exhibit a remarkably reduced heat resistance when a large amount of the foregoing phosphate is incorporated therein in an attempt to enhance the flame retardance thereof. Further, these documents do not disclose the fact that the combination of tris(nonylphenyl)phosphate, bis(nonylphenyl)phenylphosphate and nonylphenyl diphenylphosphate in predetermined proportions provides remarkable improvements in the balance of flame retardance, melt flowability, heat resistance, impact strength and water-resistant gloss retention.

Brief Summary Text (15):
A monomeric phosphate comprising a plurality of isopropyl groups and a flame retardant composition comprising the same are disclosed (GB2027712 corresponding to US4370281 and JP-B-63-61313) (The term "JP-B" as used herein means an "examined Japanese patent publication") The total number of carbon atoms in the substituents in the phosphate of these documents is as large as from 6 to 47 based on the definition in the present invention. Further, these documents do not disclose the fact that only the substituent having a specific total number of carbon atoms on the number average can give a sufficient balance between flame retardance and non-volatility. Moreover, these documents do not refer to the fact that the incorporation of the specific substituent of the present invention can provide an enhancement of flame retardance, particularly dripping flame retardance. Further, the flame retardant according to these patents comprise a plurality of isopropyl group as substituents and thus not only exhibits too high a viscosity to be easily handled but also exhibits too low a light resistance to be put into practical use.

Detailed Description Text (37):

The low volatility flame retardant for styrene resin of the present invention can be incorporated in a resin composition comprising a styrene resin blended with other thermoplastic resins. For example, a polyphenylene ether resin, a polyamide resin, a polyester resin, a polyphenylene sulfide resin, a polycarbonate resin or a polymethacrylate resin may be used singly, and two or more of these resins may be used in admixture. Preferred examples of the thermoplastic resin which can be incorporated in the styrene resin include a polyphenylene ether thermoplastic resin and a polycarbonate thermoplastic resin. The content of the other thermoplastic resin in the mixture of the styrene resin and the other thermoplastic resin is preferably from 0 to 90% by weight, more preferably from 0 to 70% by weight, most preferably from 3 to 40% by weight.

Detailed Description Text (43):
The aromatic polycarbonate as the thermoplastic resin which can be incorporated in the styrene resin can be obtained by a phosgene process in which phosgene is bubbled into an aromatic divalent phenol compound in the presence of a caustic alkali and a solvent or by an ester interchange process in which an aromatic divalent phenol compound and diethyl carbonate are subjected to ester interchange in the presence of a catalyst. The preferred viscosity-average molecular weight of the aromatic homopolycarbonate or copolycarbonate thus obtained is from 10,000 to 100,000.

Detailed Description Text (45):
The amount of the polycarbonate to be used is preferably from 1 to 40 parts by weight, more preferably from 1 to 10 parts by weight, most preferably from 3 to 7 parts by weight, per 100 parts by weight of the styrene resin used.

Detailed Description Text (99):
Examples of the foregoing epoxy compound as halogen-capturing agent include epoxidized soybean oil, tris(epoxypropyl)isocyanurate, hydroquinone diglycidyl ether, diglycidyl ester terephthalate, 4,4'-sulfobisphenol-polyglycidyl ether, N-glycidyl phthalimide, hydrogenated bisphenol A glycidyl ether, and alicyclic epoxy compounds such as 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexanecarboxylate, 2-(3,4-epoxycyclohexylspiro[5,5]-3,4-epoxy)cyclohexane-m-dioxane, bis(3,4-epoxycylohexylmethyl)adipate, vinylcyclohexene dioxide, 4-vinylepoxycyclohexane, bis(3,4-epoxy-6-methylcyclohexylmethyl)adipate, 3,4-epoxy-6-methylcyclohexyl-3,4-epoxy-6-methylcyclohexanecarboxylate, methylenebis(3,4-epoxycyclohexane), dicyclopentadiene epoxide, di(3,4-epoxycyclohexylmethyl)ether of ethylene glycol, ethylenebis(3,4-epoxycyclohexanecarboxylate), dioctyl epoxyhexahydrophthalate and di-2-ethylhexyl epoxyhexahydrophthalate.

Detailed Description Text (138):
(A) 5 g of the resin composition was dissolved in 100 ml of methyl ethyl ketone, and then subjected to separation by an ultracentrifugal separator (20,000 rpm, 1 hour). To the resulting supernatant liquid was then added methanol in an amount of twice that of the supernatant liquid to cause the resin component to separate out. The solution portion and the resin portion were then separated from each other by means of an ultracentrifugal separator. The solution portion was then analyzed by GPC (gel permeation chromatography) (available from Toso Co., Ltd. of Japan; chromatography apparatus (equipped with RI refractive index detector): HLC-8020; column: available from Toso Co., Ltd.; G1000HXL (2 sets used); mobile phase: tetrahydrofuran; flow rate: 0.8 ml/min.; pressure: 60 kgf/cm.sup.2 ; temperature: 35.degree. C. (inlet), 40.degree. C. (oven), 35.degree. C. (RI); sample loop: 100 ml; injected amount of sample: 0.08 g/20 ml). Supposing that the area ratio of the various components on chromatography are the weight fraction of the various components, the composition and content of the phosphate and dimerization and trimerization products of remaining aromatic vinyl monomer and aromatic vinyl monomer were determined from these area ratios. The resin portion was measured for the ratio of integrated value of aromatic proton or aliphatic proton by means of a Fourier transformation nuclear magnetic resonance apparatus (proton-FT-NMR). Thus, the amount of the rubber-modified or unmodified styrene resins and the thermoplastic resin such as aromatic polycarbonate and polyphenylene ether were determined.

Detailed Description Text (226):
(5) Aromatic polycarbonate (PC)

Detailed Description Text (227):
A commercial bisphenol A type polycarbonate (Novalex 8025A, available from Mitsubishi Chemical Corp. of Japan) (hereinafter occasionally referred to as "PC") was used.

CLAIMS:

8. A resin composition as claimed in claim 5, wherein said resin composition further comprises a polyphenylene ether and/or an aromatic polycarbonate in an amount of from 1 to 500 Darts by weight per 100 parts by weight of said styrene resin.